New Claims

WHAT IS CLAIMED IS:

1. An optical system for detecting anomalies of a sample, comprising:

first means for directing a first beam of radiation along a first path onto a first spot on a surface of the sample;

second means for directing a second beam of radiation along a second path onto a second spot on a surface of the sample, said first and second paths being at different angles of incidence to said surface of the sample;

a first detector; and

means including a curved mirrored surface for receiving scattered radiation from the first or the second spot on the sample surface and originating from the first or second beam and for focusing the scattered radiation to said first detector, said first detector providing a single output value in response to the radiation focused onto it by said curved mirrored surface.

2. The system of claim 1, wherein said mirrored surface is a curved surface and has an axis of symmetry substantially coaxial with the first path, defining an input aperture positioned proximate to the sample surface to receive scattered radiation therethrough from the sample surface.

3. The system of claim 2, said mirrored surface being a paraboloidal mirrored surface, the mirrored surface reflecting radiation that passes through the input aperture, said receiving and focusing means further including means for focusing radiation reflected by the mirrored surface to the first detector.

4. The system of claim 2, said mirrored surface being an ellipsoidal mirrored surface, the mirrored surface reflecting and focusing radiation that passes through the input aperture.

5. The system of claim 1, said first path being not more than about 10° angle from a normal direction to the sample surface.

6. The system of claim 5, said first path being substantially normal to the sample surface.

7. The system of claim 5, said second path being at an angle within a range of about 45 to 85 degrees to a normal direction to the sample surface.

8. The system of claim 1, said first and second beams producing a first and a second illuminated spot on the sample surface, said first and second illuminated spots substantially coinciding.

9. The system of claim 1, said first and second beams producing a first and a second illuminated spot on the sample surface, said first and second illuminated spots separated by an offset.

10. The system of claim 9, said first or second beam having a point spread function with a spatial extent, wherein said offset is not less than said spatial extent but not greater than three times the spatial extent.

11. The system of claim 1, said first and second means comprising:

a source supplying a radiation beam; and

means for converting the radiation beam supplied by the source into said first and second beams.

12. The system of claim 11, said source supplying radiation of at least a first and a second wavelength, wherein said first detector detects radiation of the first wavelength, said system further comprising a second detector for detecting radiation of the second wavelength.

13. The system of claim 11, said converting means including a switch that causes the radiation beam from the source to be transmitted alternately along the two paths towards the sample surface.

14. The system of claim 13, said system further comprising means for acquiring data from the detector at a data rate, said switch operating at a frequency of at least about three times that of the data rate.

15. The system of claim 13, said system further comprising means for acquiring data from the detector at a data rate, said switch operating at a frequency of at least about five times that of the data rate.

16. The system of claim 13, said switch including an electro-optic modulator or Bragg modulator.

17. The system of claim 1, the sample having a smooth surface, wherein the second path is at an oblique angle to the sample surface, and the second beam is P or S polarized with respect to the sample surface.

18. The system of claim 1, the sample having a rough surface, wherein the second path is at an oblique angle to the sample surface, and the second beam is S polarized with respect to the sample surface.

19. The system of claim 1, further comprising means for comparing detected scattered radiation originating from the first beam and that originating from the second beam to distinguish between particles and COPs.

20. An optical system for detecting anomalies of a sample, comprising:

first means for directing a first beam of radiation along a first path onto a surface of the sample;

second means for directing a second beam of radiation along a second path onto a surface of the sample, said first and second beams producing a first and a second illuminated spot on the sample surface, said first and second illuminated spots separated by an offset, said first and second paths being at different angles of incidence to said surface of the sample;

a detector; and

means for receiving scattered radiation from the first and second illuminated spots and for focusing the scattered radiation to said detector, said detector providing a single output value in response to the radiation focused onto it.

21. The system of claim 20, said first or second beam having a point spread function with a spatial extent, wherein said offset is not less than said spatial extent but not greater than three times the spatial extent.

22. An optical system for detecting anomalies of a sample, comprising:

a source supplying a beam of radiation at at least a first and a second wavelength; and

means for converting the radiation beam supplied by the source into a first beam at a first wavelength along a first path and a second beam at a second wavelength along a second path onto a spot on a surface of the sample, said first and second paths being at different angles of incidence to said surface of the sample;

a first detector detecting radiation at the first wavelength and a second detector detecting radiation at the second wavelength; and

means for receiving scattered radiation from the spot on the sample surface and originating from the first and second beams and for focusing the scattered radiation to said detectors, each of said detectors providing a single output value in response to the radiation focused onto it.

23. An optical system for detecting anomalies of a sample, comprising:

a source supplying a radiation beam;

a switch that causes the radiation beam from the source to be transmitted towards the sample surface alternately along a first and a second path towards a spot on the sample surface, said first and second paths being at different angles of incidence to said surface of the sample;

a detector;

means for receiving scattered radiation from the spot on the sample surface and originating from the beam along the first and second paths, said receiving means including a curved mirrored surface for focusing the scattered radiation to said detector, said detector providing a single output value in response to the radiation focused onto it by said curved mirrored surface.

24. The system of claim 23, said system further comprising means for acquiring data from the detector at a data rate, said switch operating at a frequency of at least about three times that of the data rate.

25. The system of claim 23, said switch including an electro-optic modulator or Bragg modulator.

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36. [Cancelled]

37. [Cancelled]

38. An optical method for detecting anomalies of a sample, comprising:

directing a first beam of radiation along a first path onto a first spot on the surface of the sample;

directing a second beam of radiation along a second path onto a second spot on the surface of the sample, said first and second paths being at different angles of incidence to said surface of the sample;

employing a curved mirrored surface for receiving scattered radiation from the first or second spot on the sample surface and originating from the first or second beam and focusing the scattered radiation to a first detector, and

causing said first detector to provide a single output value in response to the radiation focused onto it by said curved mirrored surface.

39. The method of claim 38, said first path being not more than about 10° angle from a normal direction to the sample surface.

40. The method of claim 38, said first path being substantially normal to the sample surface.

41. The method of claim 38, said second path being at an angle within a range of about 45 to 85 degrees to a normal direction to the sample surface.

42. The method of claim 38, said first and second beams producing a first and a second illuminated spot on the sample surface, said first and second illuminated spots substantially coinciding.

43. The method of claim 38, said first and second beams producing a first and a second illuminated spot on the sample surface, said first and second illuminated spots separated by an offset.

44. The method of claim 43, said first or second beam having a point spread function with a spatial extent, wherein said offset is not less than said spatial extent but not greater than three times the spatial extent.

45. The method of claim 38, said first and second beam directing comprising:

providing a source supplying a radiation beam; and

converting the radiation beam supplied by the source into said first and second beams.

46. The method of claim 45, said source supplying radiation of a first and a second wavelength, wherein said first detector detects radiation of the first wavelength, said method further comprising detecting radiation of the second wavelength by means of a second detector.

47. The method of claim 45, said converting including switching the radiation beam from the source alternately between the two paths towards the sample surface.

48. The method of claim 47, said method further comprising acquiring data from the first detector at a data rate, wherein said switching is at a frequency of at least about three times that of the data rate.

49. The method of claim 47, said method further comprising acquiring data from the first detector at a data rate, wherein said switching is at a frequency of at least about five times that of the data rate.

50. The method of claim 38, the sample having a smooth surface, wherein the second path is at an oblique angle to the sample surface, and the directing directs a second beam that is S or P polarized with respect to the sample surface.

51. The method of claim 38, the sample having a rough surface, wherein the second path is at an oblique angle to the sample surface, and the directing directs a second beam that is S polarized with respect to the sample surface.

52. The method of claim 38, further comprising scanning sequentially the first and second beams across the same portion of the sample surface, wherein the first but not the second beam is directed to said surface while it is being scanned in a cycle, and the second but not the first beam is directed to said surface while it is being scanned in a subsequent cycle.

53. The method of claim 38, further comprising comparing detected scattered radiation originating from the first beam and that originating from the second beam to distinguish between particles and COPs.

54. An optical method for detecting anomalies of a sample, comprising:

directing a first beam of radiation along a first path onto a surface of the sample;

directing a second beam of radiation along a second path onto a surface of the sample, said first and second beams producing a first and a second illuminated spot on the sample surface, said first and second illuminated spots separated by an offset, said first and second paths being at different angles of incidence to said surface of the sample;

receiving scattered radiation from the first and second illuminated spots and focusing the scattered radiation to a detector, and

causing said detector to provide a single output value in response to the radiation focused onto it.

55. The method of claim 54, said first or second beam having a point spread function with a spatial extent, wherein said offset is not less than said spatial extent but not greater than three times the spatial extent.

56. An optical method for detecting anomalies of a sample, comprising:

supplying a beam of radiation at at least a first and a second wavelength;

converting the radiation beam into a first beam at a first wavelength along a first path and a second beam at a second wavelength along a second path, said two beams directed onto a spot on the surface of the sample;

detecting radiation at the first wavelength by means of a first detector and radiation at a second wavelength by means of a second detector; and

receiving scattered radiation from the sample surface and originating from the first and second beams and focusing the scattered radiation to said detectors, and

causing each of said detectors to provide a single output value in response to the radiation focused onto it.

57. An optical method for detecting anomalies of a sample, comprising:

supplying a radiation beam;

switching alternately the radiation beam between a first and a second path towards a spot on the surface of the sample; and

receiving scattered radiation from the spot on the sample surface and originating from the beam along the first and second paths and focusing by means of a curved mirrored surface the scattered radiation to a detector, and

causing said detector to provide a single output value in response to the radiation focused onto it by said curved mirrored surface.

58. The method of claim 57, said method further comprising acquiring data from the detector at a data rate, wherein said switching is at a frequency of at least about three times that of the data rate.

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84. [Cancelled]

85. The system of claim 1, said curved mirrored surface focusing the scattered radiation substantially to a point at the first detector.

86. The system of claim 20, said receiving and focusing means focusing the scattered radiation substantially to a point at the detector.

87. The system of claim 22, said receiving and focusing means focusing the scattered radiation substantially to a point at the detector.

88. The system of claim 23, said curved mirrored surface focusing the scattered radiation substantially to a point at the detector.

89. The method of claim 38, wherein said focusing focuses the scattered radiation substantially to a point at the first detector.

90. The method of claim 54, wherein said focusing focuses the scattered radiation substantially to a point at the detector.

91. The method of claim 56, wherein said focusing means focuses the scattered radiation substantially to a point at the detector.

92. The method of claim 57, wherein said focusing focuses the scattered radiation substantially to a point at the detector.